Sensing colour stability and mixtures of powder paprika using optical reflectance and image analysis

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Introduction

The production and industry of paprika present several problems related to quality and to production costs. One of the main difficulties is to obtain an objetive and quick method for predicting quality. Quality in powder paprika involves: quantity of carotenoids and the appearance and stability of colour.

The method used currently for determining quality is the measurement of absorbance at 460 nm wavelength, of an acetone extract of carotenoids, but there is no information about the appearance of the paprika or the stability of its colour with time.

Another important problem is the presence of mixtures of powdered paprika produced in the Spanish region of "La Vera", which has a peculiar way of production, with a high quality and price, with other products of lower quality. It is necessary to obtain methods which are able to detect the fraud.

Material and Method

The retention of colour by paprika powdered depends on several factors. Oxygen, high temperature and light are adverse conditions that accelerate the colour deterioration. There is also a wide genetical variability, and the influence of drying conditions of the fruits.

In this work, a forced aging was applied on different samples of powder paprika. This treatment was performed in a closed box implemented with an ultraviolet lamp. Caused by this high-energy ultraviolet light treatment, the carotenoids are deteriorated in a few hours, and the rate of degradation is related to the loss of colour in storage. Furthermore, as the deterioration of the colour is different for paprikas with high and low colour retention, when there is a mixture, there will be particles with very different colour in the same sample.

We have worked with some samples of high colour retention (Quality Denomination "Pimentón de La Vera"), with one sample of low stability and with mixtures in different proportions, using two procedures.

* Reflectance spectra were obtained before and after the light treatment with a spectrophotometer (Monolight), in the visible range. Using 200 averages per sample, at 10 nm step (fron 400 to 900 nm).

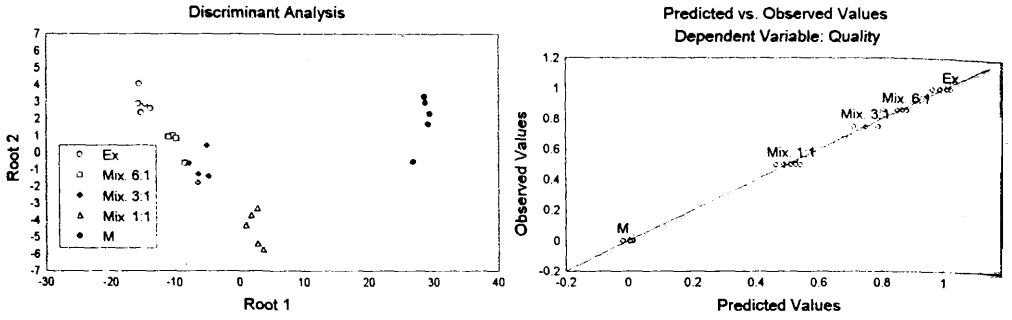
* Image analysis was performed on the samples after the ultraviolet aging. With a camera Hitachi KP-C501, connected to a PC with a Digitizing Card and Image-Pro Plus software.

Results

REFLECTANCE

Some variables were created in order to discriminate powder paprikas with different stability and to predict the percentage of mixture in the samples. The variables generated are: the reflectance spectra after the UV treatment, differences in the spectra before and after the aging at the same wavelength and color coordinates. In a second

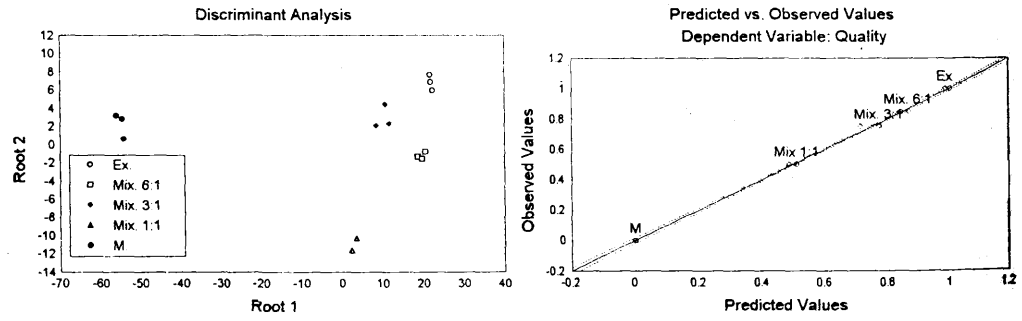
step, the objetive is to predict the percentage of mixture through systematic comparisons of the variables using data analysis techniques.



Figures 1a -1b. Discriminant Analysis: The samples are: EX, with good stability of carotenoids. M, with low stability and mixtures 6:1, 3:1 and 1:1 of both. Using a Linear Multivariable Regression (95 % confidence), it is possible to predict quality as percentage in the mixture of parpika of good stability, with an Adjusted R^2=0.99.

IMAGE ANALYSIS

The imagen acquisition is made on samples that were exposed to the ultraviolet light aging. From the image, and through a software created in our laboratory, the histograms are analyzed. Some variables are generated from the histogram of the images, which can discriminate betwen different quality classes and it is able to predict the degree of mixture.



Figures 2a-2b. As in reflectance, with the Image Analysis data, it is possible segregate the samples. Using a Linear Multivariable Regression (95 % deconfidence), it is possible to predict quality too, with an Adjusted R^2= 0.99.

References

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